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ABSTRACT

The document presents the final report of the Initial Learning in Mainstreaming Project, which developed and tested instructional techniques in 14 specific mathematics skill areas with 429 handicapped and normal elementary school students in Grace and Soda Springs, Idaho. Skill areas included addition facts; subtraction facts; carrying (regrouping); borrowing (regrouping); multiplication facts; division facts; multiplication processes to three digits; long division process to remainder; least common denominator; off base 10 (time: hours, minutes, seconds); off base 10 (time: years, months, weeks, days); rounding numbers; one variable story problems; and long division process with remainder as a fraction and decimal. (DLS)

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Initial Learning in Mainstreaming Project

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FINAL REPORT

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School Districts 148 & 150
Grace & Soda Springs
IDAHO

Funding Source:
Title III 306 ESEA
Year: 1975 - 76
Project Director:
Neldon Kingston

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I.

Project Name: Initial Learning in Mainstreaming Project

Project Address: School District #148, Grace, Idaho 83241

Project Districts: School District #148, Grace, Idaho 83241
School District #150, Soda Springs, Idaho 83276

Project Districts Superintendents: C.D. Simmons, Gene C. Millward
School District #148

Ellis L. Williams
School District #150

Project Director: Neldon Kingston

Grant Amount: $53,300.00

Original Project Duration: 7/1/75 to 6/30/76

Project Extension Duration: 7/30/75 to 12/31/76

Project Target Population: Mainstreaming Handicapped pupils in the regular classroom.

Experimental Population Numbers

In the main project there were 305 students involved in experimental condition classroom; of these 305, 21 of the students were mainstreaming handicapped pupils. There were 12 experimental condition regular teachers and 4 special education teachers who were involved with these students. In the project extension, there were 124 students involved in experimental condition classrooms; of these, 7 were mainstreaming handicapped pupils. There were 4 experimental condition regular teachers and 3 special education teachers who were involved with these students. There may be some overlapping of teachers and students between the main project and the project extension.

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FINAL REPORT

I. Project Description

The Initial Learning In Mainstreaming Project, Joint School Districts #148 and #150, Grace and Soda Springs, Idaho, is a Title III 306 E.S.E.A. project intended to make more profitable the mainstreaming of handicapped pupils. It has as a major emphasis the improvement of instruction of that portion of the day that the handicapped student spends in the regular classroom. Research and experience suggests that instructional sequence is especially critical for the handicapped pupil. When this is coupled with the recent state and national emphasis on the "least restrictive environment" for handicapped students, a definite need becomes apparent, not only for strong resource rooms but also for regular classroom instruction which is capable of instructing the handicapped child within the confines of the regular classroom.

With the development of resource rooms and resource teachers as models for serving the needs of handicapped pupils, a critical question has become how to provide a profitable mainstream experience for these handicapped individuals. Since the difficulty of corrective instruction, once considerable negative learning has occurred, is well documented, the question becomes one of how to increase initial mastery and decrease concept error, at the time of initial instruction for handicapped pupils, in a manner which will not stigmatize the handicapped individual.

The project programmed 14 specific math skill areas (listed in appendix A). The following considerations were paramount in programming the material (1) material effectiveness, (2) ability to be naturally integrated with the regular classrooms management system and (3) minimal inservice requirements. The need for material effectiveness is obvious. However, the need for the other two considerations is somewhat subtler. It was considered essential that the material be able to fit into the regular classrooms management system. If the material didn't do this, then once the pressure of the grant conditions was removed the material would either not be used or would be altered so radically by the classroom teachers that the loss of effectiveness might well be the outcome. That this all too often occurs is addressed by Bliel (1975) when he maintains that the most important question a teacher can ask him or herself when they are selecting structured programmed material, is whether the teacher is willing to use the material in the form it is prepared. Bleil concludes:

> If you are not willing to do this, the results will be different just as changing the ingredients in a cooking recipe leads to a different end product. It i your self-appraisal of your willingness to cooperate that is the real secret to success in using materials.

The need for minimal inservice was an important consideration as not all teachers in the districts were involved as experimental classrooms and it was the intent that after the project was completed that the material would be made available to all teachers to use. Material that requires extensive inservice in order to be used probably sets up a natural barrier to easy and early dissemination.

The material developed contained, at least, the following aspects:

1. A criterion referenced monitor approach to record keeping.

2. Carefully sequenced material designed to facilitate concept mastery and decrease negative learning which was presented as part of the regular classroom instructional program.

3. A system of modeling the desired format of instruction that allowed the teacher to learn how to present the material at the same time the classroom was learning the material. This minimized inservice and prior preparation requirements.

4. A remedial loop provision to be used with students still showing a lack of concept mastery when the class was ready to move on.

II.

A. Rationale

The basic rationale is formed from the evaluated needs of handicapped pupils in a mainstreaming situation. The concept of resource rooms, resource teachers and mainstreaming came about because of a recognition that certain critical social concepts can only be learned in a social context, and that self-contained programs could not provide that context. Even with this consideration it is none the less important that adequate instruction occur for the handicapped student during his mainstreaming time. The need for more adequate instruction does not sit as an isolated need of mainstreaming handicapped pupils, however. Many other students

also need more adequate instruction, often in the same area as the handicapped. That this need occurs in the classroom across wide geographic areas is illustrated by the work of Austin and Prevost (1972) which involved a longitudal study of an entire state. Earlier work by the school districts involved in the project convinced the districts of two things, (1) that the needs of the mainstreaming handicapped and many regular students could be matched, thus making feasible a regular classroom approach to the problem and (2) that the place the additional programming needed to occur was during initial instruction. Too often the handicapped pupil experiences negative learning in the regular classroom, making the job of the resource room harder and unnecessarily increasing the amount of resource room time needed by the pupil.

Programming at the time of initial instruction has several advantages (1) it allows the entire classroom to receive the same instruction at the same time thus eliminating stigma for the handicapped pupil, (2) because group instruction is the form of classroom management most commonly used by classroom teachers it enhances the possibility that the material will continue to be used when the grant is completed. It has been the experience of the school districts involved in the project that the less management adjustment a teacher has to make to accommodate instructional material, the greater the likelihood that the material will continue to be used in an independent manner after the project is complete. Agreement between current classroom management and instructional material requirements, in the experience of the districts, also seems to effect the degree that material is used as intended.

Cartwright, Cartwright and Robine (1972) make the point well when speaking in regards of handicapped pupils when they state

> .....programs should be designed to prepare regular class teachers to provide individualized instruction for children in order to prevent the development of serious learning problems and to ameliorate existing learning problems early in a child's educational career. (pg. 453)

Wadsworth (1971) also adds support to this when he states, "The educational program [sic] of disabled learners is critical." (pg. 41)

The difficulty of reteaching negatively learned concepts is well accepted and underscores the need for adequate first time instruction. That this is especially critical for the

handicapped is well illustrated in a study[1] by Preham, Logan and Towle (1972) in which they found the retarded experience the greatest amount of difficulty in the early stages of instruction and that while retarded students continue to improve from stage to stage that the regular student had reached a plateau after the second stage of instruction. It was proposed by the project school districts that most classroom instruction is not adequate for handicapped students in the early stages of instruction where the handicapped pupil struggles the hardest and that it is most likely to end when the regular students reach their plateau without provision for those still in the process of mastery.

B. Support System Description

The material was found to fit quite easily into the routine of the regular classroom. Resistance to the management system was virtually non-existent and almost all teachers have continued with the material the next year on their own. Many other teachers have adopted the materials for use in the classrooms on their own iniative. Detailed management descriptions are available in the teachers manual for each skill area. In general, the management system for the skill areas had the following elements in common:

1. Group instruction
2. Pretest of prerequisite skills where necessary
3. A tape-transparency teaching format (some areas are filmstrips)
4. An easy to use monitor system that provided very quick feedback to students and teachers early in the instruction
5. Sufficiency of worksheet practice
6. A remedial loop provision

In most cases instruction occupied no more classroom time than had traditionally been assigned for teaching the instructional unit.

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[1]This study has been replicated in more than on location.

Statement of Objectives

The following were objectives of the Initial Learning in Mainstreaming Project concerning the educational advancement of handicapped and non-handicapped pupils.

(1) 70% of handicapped pupils in the target[2] classrooms, grades k-6, shall master at a 70% level project target skills of their grade level in the regular classroom during the 1975-76 school year as measured by criterion referenced testing.

(2) 80% of regular pupils in the project target classrooms, grades k-6 shall master at an 80% level project target skills of their grade level in the regular classroom during the 1975-76 school year as measured by criterion referenced testing.

The non-handicapped pupil objective was included in a handicapped child grant because it was considered critical to assess the effect the material had on regular as well as handicapped pupils. If classroom teachers are to use the material for their entire class then the material must not hurt and perferably must help regular pupils as well as handicapped pupils.

The following were objectives pertaining to other aspects of the project:

(1) Fourteen instructional sequences will be adjusted so as to be feasible for regular classroom use during the 1975-76 summer and school year during preservice and in-service.

(2) 100% of involved school personnel shall understand 100% of goals, data requirements and collection system as measured by criterion referenced test.

(3) A workshop in classroom management shall be taught involving school personnel during the summer and/or 1975-76 school year.

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[2]Target refers to experimental in the hard data analysis.

Educational Objectives

Report of Objective Attainment

Objective #1 70% of handicapped pupils in the project target classrooms, grades k-6, shall master at a 70% level project target skills of their grade level in the regular classroom during the 1975-1976 school year as measured by criterion reference testing.

The accomplishment of this objective is as follows:*

The following instructional sets met this objective:

Addition Facts - grade 1	100%
Addition Facts - grade 2	100%
Subtraction Facts - grade 1	100%
Multiplication Facts - grade 3	100%
Carrying (Regrouping) - grade 2	100%
Off Base 10 - grade 5 time with hours, minutes, seconds	75%
Long Division - grade 4 Process to Remainder (2 of 3 subsections)	100%, 75%, (50%)
Rounding Numbers - grade 6	100%

The following instructional sets almost met the objectives:

Subtraction Facts - grade 2	67%
Division Facts - grade 4	67%

The following instructional sets were not close to meeting the objective:

Borrowing (Regrouping) - grade 2	50%
Multiplication Process - grade 4 (Multiple Multiplier)	40%
Long Division - grade 4 Process to Remainder	33%

*See footnote at the bottom of page 8

Least Common Denominator - grade 5 50%

**Off Base 10 - grade 5 0%
Time with years, months, weeks, days

Long Division - grade 4 50% (100%,75%)
Process with Remainder
(1 of 3 subsection)

One Variable Story Problems - grade 6 25%

Objective #2 80% of regular pupils in the project target classrooms, grades k-6, shall master at an 80% level project target skills of their grade level in the regular classroom during the 1975-1976 school year as measured by criterion reference testing.

The accomplishment of this objective is as follows:*

The following instructional sets met this objective:

Addition Facts - grade 1 92%

Addition Facts - grade 2 93%

Subtraction Facts - grade 1 98%

Subtraction Facts - grade 2 87%

Multiplication Facts - grade 3 91%

Division Facts - grade 4 96%

Carrying (Regrouping) - grade 2 96%

Borrowing (Regrouping) - grade 2 85%

Long Division - grade 4 86%
Process to Remainder

Least Common Denominator - grade 5 89%

Off Base 10 - grade 5 96%
Time with hours, minutes, & seconds

Long Division - grade 6 100%, 100%, 92%
Process with Remainder (all areas)

Rounding Numbers - grade 6 96%

The following instructional sets almost met the objective:

Multiplication Process - grade 4 79%
(Multiple Multipliers)

One Variable Story Problems - grade 6 78%

* See footnote at the bottom of page 8
** See footnote at the bottom of page 8

The following instructional set was not close to meeting the objective:

** Off Base 10,- grade 5 Time with years, months, weeks, and days	44%

*These measures are not delay retention measures. Statistical significance is based on delay retention measures given at the close of the school year. Some units taught near the end of the school year have small amounts of delay while units taught early in the school year have considerable delay. Objective attainments are based on process not total scores (see note on page 25 for a definition of process and page 27 for an explanation).

**This instructional unit is very similar to Off Base 10, Time, Hours, Minutes, Seconds. Probably the difficulty with this set is caused by the unit being taught at the end of the school year. Teachers underestimated the amount of time required to teach the unit and as a consequence they did not complete the instructional materials.

Report of Subordinate Objectives

Attainment of Subordinate Objectives

Objective 1.

> Fourteen instructional sequences will be adjusted so as to be feasible for regular classroom use during the 1975-76 summer and school year during preservice and inservice.

This objective was accomplished 100%.

Objective 2.

> 100% of involved school personnel shall understand 100% of goals, data requirements and collection system as measured by criterion referenced test.

This objective was accomplished 100%

Objective 3.

> A workshop in classroom management shall be taught involving school personnel during the summer and/or 1975-76 school year.

This objective was accomplished. The workshop was limited to project personnel, building administrators who had the project in their building, experimental teachers and special education teachers.

W. R. A. T. Data

As can be seen in Table 1, there were two grades where W. R. A. T. gains were significant. The third grade and the fifth grade. W. R. A. T. gains approached significance in the second grade. Like most achievement tests, the W. R. A. T. measures many skills. Not all of these skills (indeed, a minority of skills) from the W. R. A. T. will be represented by the project areas for a given grade. The matching of a norm referenced achievement test and specific at grade skills is always a difficult endeavor.

Statistical Data

A complete listing of data can be found in Table 1. Statistical significance was obtained on the following skill areas.

Addition Facts - grade 2 $<.01$

Subtraction Facts - grade 1 .05

Subtraction Facts - grade 2 $<.01$

Division Facts - grade 4 .01

Carrying (regrouping) - grade 2 $<.001$

Borrowing (regrouping) - grade 2 $<.0005$

Multiplication Process (multiple multipliers) grade 4 $<.001$

Least Common Denominator - grade 5 $<.01$

Off Base 10, Time, Hrs., Min., Sec. - grade 5 .05

Major Problems Encountered

Trying to instruct the mainstreaming handicapped pupil in the regular classroom under experimental - control conditions proved to be somewhat of a problem. Classroom teachers, from time to time, switched the time of day the instruction was given. This made it almost impossible to avoid conflicts with the time that the student was assigned to the resource room. The project intent of providing the instruction in the regular classroom made it impossible to use resource room time for instruction with the project materials. This conflict in times between regular class instruction and resource room assignment was never completely resolved.

Project Data

Table 1

	Grade Placement of Material	Process				Total				W.R.A.T. Sig.	W.R.A.T. Sig. Lower 1/2 of class
		% Reaching 80% (Regular Students)	% Reaching 70% (Handicapped)	Sig. Level **	Sig. Level Lower 1/2 of Class **	% Reaching 80% (Regular Students)	% Reaching 70% (Handicapped)	Sig. Level **	Sig. Level Lower 1/2 of Class **		
Addition Facts	1	92	100	NS	NS	NA	NA	NA	NA	NS	NS
Addition Facts	2	93	100	<.01	<.05	NA	NA	NA	NA	NS	*
Subtraction Facts	1	98	100	.05	NS	NA	NA	NA	NA	NS	NS
Subtraction Facts	2	87	67	<.01	*	NA	NA	NA	NA	NS	*
Carrying (Regrouping)	2	96	100	<.001	<.05	96	75	<.001	<.05	NS	NS
Borrowing (Regrouping)	2	85	50	<.0005	<.0005	73	75	<.0005	<.0005	NS	NS
Multiplication Facts	3	91	100	NS	NS	NA	NA	NA	NA	<.05	<.05
Division Facts	4	96	67	.01	NS	NA	NA	NA	NA	NS	NS
Multiplication Process to 3 Digit	4	79	40	.001	NS	35	33	.001	NS	NS	NS
Long Division Process to Remainder	4	86	33	NS	NS	78	50	NS	NS	NS	NS
Least Common Denominator	5	89	50	<.01	<.01	89	50	<.01	<.01	<.001	<.05
Off Base 10 Time Hr., Min., Sec.,	5	96	75	.05	NS	91	60	NS	NS	<.001	<.05
Off Base 10 Time Yr. Mo. Wk. Da.	5	44	0	NS	NS	44	0	NS	NS	<.001	<.05
Rounding Numbers	6	96	100	NS	NS	77	100	NS	NS	NS	NS
One Variable Story Problems	6	78	25	NS	NS	73	25	NS	NS	NS	NS
Long Division Process with Remainder frac.	6	100	100			100	100				
DE		100	75			92	75				
DU		92	50	NS	NS	77	50	NS	NS	NS	NS

* = Approaches Significance

** = Significanc tests are delay measures given a the close of the school year.

frac. = Remainde: as a fraction
DE = Remainder as an even decimal
DU = Remainder as an uneven decimal

Project Extension

Discussion

An extension of the project was obtained (12/31/76) which allowed the project to utilize some unexpended funds on revision of some of the project skill areas. Because of the termination date of the extension, it was necessary to move all of the skills contained in the extension except Rounding Numbers up a grade. This was necessary because the grade that the concept was originally taught would not deal with the skill area until the second semester of the school year.

Experimental Design of the Extension

The experimental design for the extension is the same as for the non-extension portion of the grant except that both the experimental and control group contained only one classroom. The experimental design was again the non-equivalent control group design with random assignment of classrooms and treatment. Analysis of covariance with an adjustment for unequal N was used with the pretest as the covariant, to control for initial differences.

Problems Encountered in the Project Extension

Problem #1 The experimental teacher in the 5th grade underwent major surgery just before she was scheduled to start using the material. Her recovery was considerably slower than anticipated. The substitute put off using the material hoping for the return of the regular teacher. This gave her a late start on the Division Fact Unit. She did not start the Long Division to Remainder Unit at all. The regular teacher started this on her return. She returned approximately one week before the final measure. This gave the experimental class about 1/3 the time on the concept that the control group spent.

Problem #2 The 1st grade teacher who taught the 2nd grade control group the preceeding year did not emphasize the math facts. As a result, the 2nd grade control group pre-test was considerably below the experimental group pre-test. This difference was so great that at the end of the project extension the control group post-test was still below the experimental group pre-test. Although this problem is somewhat compensated for by using an analysis of covariance, there would still be some problem in the statistical analysis of the addition facts.

Discussion of Extension Data

Report of Objective Attainment

Criterion Data

Objective #1 70% of handicapped pupils in the project target classrooms, grades k-6, shall master at a 70% level project target skills of their grade level in the regular classroom during the 1975-1976 school year as measured by criterion reference testing.

The accomplishment of this objective is as follows:

The following instructional sets met this objective:

Addition Facts - grade 2	100%
Multiplication Facts - grade 4	100%
Rounding Numbers - grade 6	100%

The following instructional sets did not meet this objective:

*Division Facts - grade 5	67%
*Long Division Process to Remainder - grade 5	33%

Objective #2 80% of regular pupils in the project target classrooms, grades k-6, shall master at an 80% level project target skills of their grade level in the regular classroom during the 1975-1976 school year as measured by criterion reference testing.

The accomplishment of this objective is as follows:

The following instructional sets met this objective:

Addition Facts - grade 2	96%
Multiplication Facts - grade 4	81%
Rounding Numbers - grade 6	86%

The following instructional sets did not meet the objective:

*Division Facts - grade 5	72%
*Long Division to Remainder - grade 5	40%

* These sets were placed in the 5th grade. See the preceeding page under Problem #1 for a discussion of problems in the fifth grade.

Discussion of Extension Criterion Data

Measurement of objective attainment is based upon process scores, as this involves the process being taught. Prerequisite skills are not commonly taught with regular classroom instructional units. A comparison of data on Table 1 and Table 2 indicates that both of the instructional sets which did not meet objective criterion (5th grade sets) indicates that handicapped child performance was as good as previous results and closer to the performance level of their regular class peers. This tends to suggest that revision improvements may have been beneficial to the handicapped pupil. If conditions for the 5th grade experimental classroom had been more normal, it is quite possible that handicapped pupil gains would have surpassed the previous mastery level of handicapped pupils. It is also interesting to note that in areas meeting objective #2, that 100% of the handicapped pupils met the 70% criterion of the objective.

W.R.A.T.

The only W.R.A.T. analysis to reach significance is for the lower half of the 5th grade. The substitute teacher in the 5th grade spent considerable time dealing with prerequisite skills during the earlier part of her substituting (until she found out how long the teacher would be gone) rather than introduce new concepts. It is unknown if this can account for the level of significance of the lower half of the class in regard to W.R.A.T. scores.

Statistical Analysis

Adaptions to Rounding Numbers and Multiplication Facts for the extension proved to be highly significant. Addition Facts was very close to significance for the lower half of the class.

Project Extention Data - Table 2

	Grade of Material Placement	% Reaching 80% (Regular Students)	% Reaching 70% (Handicapped)	Sig. Level **	Sig. Level Lower 1/2 **	% Reaching 80% (Regular Students)	% Reaching 70% (Handicapped)	Sig. Level **	Sig. Level Lower 1/2 **	W.R.A.T.	W.R.A.T. Lower 1/2	
Addition Facts	2	96	100	NS	*	NA	NA	NA	NA	NS	NS	
Multiplication Facts	4	81	100	<.0005	<.0005	NA	NA	NA	NA	NS	NS	
Long Division to R	5	40	33	NS	NS	32	50	NS	NS	NS	<.05	
Division Facts	5	72	67	NS	NS	NA	NA	NA	NA	NS	<.05	
Rounding Numbers	6	86	100	<.0005	<.0005	86	100	<.0005	<.0005	NS	NS	
		Process				Total						

* Approaches significance

** Significance measure involves a delay measure

TABLE 3

HANDICAPPED CHILD

Deviation from Baseline

GRADE 1

ADDITION FACTS

EXPERIMENTAL

Student #	Pre	Post	Diff.
1	25	85	60
2	6	55	49
Mean	15.5	70	54.5

CONTROL

Student #	Pre	Post	Diff.
1	2	50	48
2	20	78	58
3	3	31	28
4	2	63	61
Mean	6.8	55.5	48.8

There is a mean difference of 5.7 in favor of the Experimental group.

SUBTRACTION FACTS

Student #	Pre	Post	Diff.
1	0	37	37
2	0	25	25
Mean	0	31	31

Student #	Pre	Post	Diff.
1	2	17	15
2	6	36	30
3	0	20	20
4	2	24	22
Mean	2.5	24.2	21.8

There is a mean difference of 9.2 in favor of the Experimental group.

GRADE 2

ADDITION FACTS

Student #	Pre	Post	Diff.
1	50	90	40
2	30	97	67
3	38	86	48
Mean	39.3	91	51.7

Student #	Pre	Post	Diff.
1	64	104	40
2	44	59	15
Mean	54	81.5	27.5

There is a mean difference of 24.2 in favor of the Experimental group.

SUBTRACTION FACTS

Student #	Pre	Post	Diff.
1	17	79	62
2	9	54	43
3	24	13	11
Mean	16.7	48.6	38.7

Student #	Pre	Post	Diff.
1	24	43	19
2	7	38	31
Mean	15.5	40.5	25

There is a mean difference of 13.7 in favor of the Experimental group.

Process / Total

GRADE 2 CARRYING - (REGROUPING)

EXPERIMENTAL

Student

#	Pre	Post	Diff.
1	0/0	80/80	80/80
2	0/0	100/50	100/50
3	0/0	90/60	90/60
Mean	0/0	90/63.3	90/63.3

CONTROL

Student

#	Pre	Post	Diff.
1	20/10	0/0	20/10
2	70/50	90/90	20/40
Mean	45/30	45/45	20/25

There is a mean difference of 70/38.3 in favor of the Experimental group.

BORROWING - (REGROUPING)

Student

#	Pre	Post	Diff.
1	0/0	100/100	100/100
2	0/0	30/0	30/0
3	0/0	90/60	90/60
Mean	0/0	73.3/ 53.3	73.3/ 53.3

Student

#	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	40/40	40/40
Mean	0/0	20/20	20/20

There is a mean difference of 53.3/ 33.3 in favor of the Experimental group.

GRADE 3 MULTIPLICATION FACTS

Student

#	Pre	Post	Diff.
1	11	37	26
2	0	57	57
Mean	5.5	47	41.5

Student

#	Pre	Post	Diff.
1	23	52	29
2	0	110	110
Mean	11.5	81	69.5

There is a mean difference of 28.0 in favor of the Experimental group.

GRADE 4

DIVISION FACTS

Process / Total

EXPERIMENTAL

Student #	Pre	Post	Diff.
1	24	168	144
2	49	166	117
3	27	156	129
4	41	167	126
5	12	39	27
6	0	37	37
Mean	25.5	122.2	96.7

CONTROL

Student #	Pre	Post	Diff.
1	68	121	53
2	0	117	117
3	24	36	12
4	20	163	143
5	0	72	72
6	0	136	136
Mean	18.6	107.5	88.8

There is a mean difference of 7.9 in favor of the Experimental group.

MULTIPLICATION TO 3 DIGIT

Student #	Pre	Post	Diff.
1	0/0	60/30	60/30
2	0/0	100/80	100/80
3	0/0	100/80	100/80
4	0/0	100/100	100/100
5	0/0	0/0	0/0
6	0/0	0/0	0/0
Mean	0/0	60/48.2	60/48.2

Student #	Pre	Post	Diff.
1	0/0	60/50	60/50
2	0/0	60/30	60/30
3	0/0	0/0	0/0
4	0/0	70/30	70/30
5	0/0	0/0	0/0
6	0/0	10/10	10/10
Mean	0/0	33.3/20	33.3/20

There is a mean difference of 26.7/28.2 in favor of the Experimental group.

DIVISION TO REMAINDER

Student #	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	60/40	60/40
3	0/0	60/40	60/40
4	0/0	100/100	100/100
5	0/0	0/0	0/0
6	0/0	0/0	0/0
Mean	0/0	36.6/30	36.6/30

Student #	Pre	Post	Diff.
1	0/0	40/30	40/30
2	0/0	100/100	100/100
3	0/0	0/0	0/0
4	0/0	0/0	0/0
5	0/0	0/0	0/0
6	0/0	40/40	40/40
Mean	0/0	30/28.3	30/28.3

There is a mean difference of 6.6/1.7 in favor of the Experimental group.

GRADE 5 OFF BASE 10 - HRS., MIN., SEC.

Process / Total

EXPERIMENTAL

Student #	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	40/20	40/20
3	0/0	0/0	0/0
4	0/0	30/30	30/30
Mean	0/0	17.5/12.5	17.5/12.5

CONTROL

Student #	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	0/0	0/0
3	0/0	0/0	0/0
4	0/0	0/0	0/0
Mean	0/0	0/0	0/0

There is a mean difference of 17.5/12.5 in favor of the Experimental group.

OFF BASE 10 - WK., MO., DA.

Student #	Pre	Post	Diff.
1	0/0	10/10	10/10
2	0/0	40/40	40/40
3	0/0	0/0	0/0
4	0/0	0/0	0/0
Mean	0/0	12.5/12.5	12.5/12.5

Student #	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	0/0	0/0
3	0/0	0/0	0/0
4	0/0	0/0	0/0
Mean	0/0	0/0	0/0

There is a mean difference of 12.5/12.5 in favor of the Experimental group.

LEAST COMMON DENOMINATOR

Student #	Pre	Post	Diff.
1	0/0	60/60	60/60
2	0/0	100/100	100/100
3	0/0	30/30	30/30
4	0/0	20/20	20/20
Mean	0/0	52.5/52.5	52.5/52.5

Student #	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	30/30	30/30
3	0/0	0/0	0/0
4	0/0	0/0	0/0
Mean	0/0	7.5/7.5	7.5/7.5

There is a mean difference of 45.0/45.0 in favor of the Experimental group.

GRADE 6

DIVISION WITH REMAINDER

Process / Total

EXPERIMENTAL

Student #	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	100/90	100/90
3	0/0	0/0	0/0
4	0/0	40/40	40/40
Mean	0/0	35/32.5	35/32.5

CONTROL

Student #	Pre	Post	Diff.
1	0/0	0/0	0/0
2	0/0	0/0	0/0
3	20/20	100/100	80/80
Mean	6.6/6.6	33.3/33.3	26.6/26.6

There is a mean difference of 8.4/5.9 if favor of the Experimental group.

ROUNDING

Student #	Pre	Post	Diff
1	30/30	90/90	60/60
2	20/20	90/90	70/70
3	10/10	0/0	-10/-10
4	10/10	20/20	10/10
Mean	17.5/17.5	50/50	32.5/32.5

Student #	Pre	Post	Diff.
1	0/0	20/20	20/20
2	20/20	60/60	40/40
3	0/0	0/0	0/0
Mean	6.7/6.7	26.7/26.7	20/20

There is a mean difference of 12.5/12.5 in favor of the Experimental group.

STORY PROBLEMS

Student #	Pre	Post	Diff.
1	60/40	100/80	40/40
2	10/0	50/50	40/50
3	0/0	40/40	40/40
4	10/10	10/10	0/0
Mean	20/12.5	50/45	30/32.5

Student #	Pre	Post	Diff.
1	0/0	70/50	70/50
2	30/20	60/50	30/30
3	40/30	60/50	20/20
Mean	23.3/16.7	63.3/50	40/33.3

There is a mean difference of 10/.8 in favor of the control group.

EXTENSION

GRADE 2 ADDITION FACTS

EXPERIMENTAL

Student #	Pre	Post	Diff.
1	8	27	19
Mean	8	27	19

CONTROL

Student #	Pre	Post	Diff.
1	9	31	22
Mean	9	31	22

There is a mean difference of 3 in favor of the Control group.

GRADE 4 MULTIPLICATION FACTS

Student #	Pre	Post	Diff.
1	77	120	43
2	76	90	14
Mean	76.5	105	28.5

Student #	Pre	Post	Diff.
1	61	64	3
Mean	61	64	3

There is a mean difference of 25.5 in favor of the Experimental group.

GRADE 5 DIVISION FACTS

Student #	Pre	Post	Diff.
1	94	116	22
2	110	105	- 5
Mean	102	110.5	8.5

Student #	Pre	Post	Diff.
1	0	2	2
2	12	9	-3
3	43	32	-11
4	40	43	3
Mean	23.8	21.5	-2.3

There is a mean difference of 10.8 in favor of the Experimental group.

GRADE 6 ROUNDING DECIMALS

Student #	Pre	Post	Diff.
1	40/100	40/100	0/0
2	10/0	10/0	0/0
Mean	25/50	25/50	0/0

Student #	Pre	Post	Diff.
1	20/20	20/20	0/0
2	20/10	20/10	0/0
Mean	20/15	20/15	0/0

There is 0/0 difference between the Experimental and Control groups

EXTENSION

GRADE 5 LONG DIVISION TO REMAINDER

EXPERIMENTAL

Student #	Pre	Post	Diff
1	70/80	70/80	0/0
2	0/0	0/0	0/0
Mean	35/40	35/40	0/0

CONTROL

Student #	Pre	Post	Diff
1	0/0	0/0	0/0
2	0/0	0/0	0/0
3	0/0	0/0	0/0
4	0/30	0/70	0/40
Mean	0/7.2	0/17.2	0/10

There is a mean difference of 0/10 in favor of the Control group.

Deviations from Baselines Discussion

Out of 16* deviation from baselines for handicapped pupils in the main project, 15 were in favor of the experimental group and one was in favor of the control group. In the project extension, two out of five handicapped student deviation from baselines were in favor of the experimental group, one deviation from baseline was in favor of the control group. One deviation from baseline showed no difference between experimental and control condition and one deviation from baseline showed no difference between conditions for process scores and a difference in favor of the control condition for total scores. Scores for respective skill areas can be formed in Table 3.

*There were 14 skill areas in the main project. Two additional deviation from baselines were obtained because addition and subtraction facts were in both the first and second grades.

Test - Retest Reliability

Test - retest reliability for criterion measures is reported in Table 4. A careful study of the table will illustrate that in areas that the correlation is low that this is caused by a lack of variability in the scores rather than a lack of test - retest reliability. For example, a comparison of the addition facts and division facts shows that the addition facts have a very low correlation coefficient but a very high percent of agreement between tests. The division facts show a much lower percent of agreement but a much higher correlation coefficient. Because variability is required in order to obtain meaningful correlation, percent of agreement for the criterion measures as well as the correlation coefficient is presented in Table 4.

Table 4

Percent of Agreement Between Scores

	% Perfect Agreement		% Off 10 % 99-90		% Off 20% 89-80		% Greater than 20%		Correlation		
	Pro.	Tot.	Pro.	Tot.	Pro.	Tot.	Pro.	Tot.	Pro.	Tot.	
Addition Facts		74		26		0		0		.023	
Subtraction Facts		68		32		0		0		.463	
Multiplication Facts		16		80		4		0		.860	
Division Facts		36		45		18		0		.853	
Story Problems	58	29	42	67	0	4	0	0	.794	.670	
Least Com. Den.	27	27	41	41	23	27	9	5	.726	.760	
Long Div. to R	54	50	32	40	9	5	5	5	.611	.683	
Long Div. With R	44	48	44	40	8	8	4	4	.557	.570	
3 Digit. Mult.	52	22	30	26	9	30	9	22	.032	.232	
Hrs., Min., Sec.	18	12	35	47	29	23	18	18	.667	.691	
Yr., Mo., Wk.	28	28	33	33	22	17	17	22	.435	.652	
Rounding Numbers	80	75	15	20	0	0	5	5	.727	.718	
Carrying	79	50	17	29	0	17	4	4	.202	.146	
Borrowing	65	52	22	26	9	17	4	4	.254	.064	

Retention of Arithmetic Facts

Conditions were such that a follow up was able to be obtained for one experimental classroom and the control group for the multiplication tables. The post test of the main project and the pretest of the project extension was able to be used to obtain scores on the degree of fact loss over the summer. This could not be obtained for the addition facts as there was too much student placement into other classes not involved in the extension. Data for the retention of multiplication facts is presented in Table 5. The statistical procedure used was an analysis of covariance with an adjustment for unequal N. The spring, 1976, testing was used as the covariant. It can be noted that the experimental group maintained their multiplication facts better over the summer but this difference did not reach statistical significance.

Table 5

Retention of multiplication facts between one experimental and the control group.

Experimental Class

Test Mean- 1976

Spring	Fall	Mean Loss
75.56	62.48	13.08

Control Class

Test Mean- 1976

Spring	Fall	Mean Loss
84.83	60.70	24.13

Mean loss difference is 11.05 in favor of the experimental class. The difference does not reach statistical significance.

Evaluation Conditions

Note: Criterion measures with the exception of the Arithmetic Facts were scored for Process and Total.

> Process is defined as those procedures involved in the direct performing of the respective task. Process does not involve prerequisite skills, it only involves the skill being taught. For example, long division involves borrowing at times, but borrowing errors would not be counted against the long division process.
>
> Total is defined as those total aspects that lead to a correct answer to the problem. This involves the respective process and all prerequisite skills. For example, long division involves borrowing at times and a borrowing error would be counted against the total score.

See Page 27 for an explanation as to why scoring was done for process and total.

Experimental Design and Conditions

Design

The experimental design utilized was a nonequivalent control group design with random assignment of intact classrooms to treatment conditions. Volunteer teachers were sought in the two school districts and assigned by random drawing to treatment conditions. During the drawing, stratification was done so that each school district had an equal number of experimental and control groups.

Statistical Analysis

Data analysis was done in two ways.

(1) Criterion analysis
(2) Statistical analysis

For the statistical analysis, an analysis of covariance with an adjustment for unequal N was used. The pretest was used as the covariant in order to control for initial differences between the experimental and control group. In some cases all pupils scored zero on the pretest making necessary the use of analysis of variance instead of analysis of covariance.

Because the instructional program of the regular classroom for the handicapped child is the concern area of the grant, it is important to assess not only the effect the material has on the handicapped but also the regular student as well. For this reason there is criterion objectives for both handicapped and regular students. There is also a statistical analysis for regular students and a deviation from baseline for handicapped pupils (inadequate N for handicapped pupils make a deviation from baseline necessary.). A statistical analysis for the bottom half of the class was done in order to obtain statistical data on students that might be expected to have difficulty. Data for the project is reported in Table 1. Data for the grant extension is reported in Table 2. Data for deviation from baseline for handicapped pupils is reported in Table 3 and test retest reliability for the criterion instruments is reported in Table 4. Classes happen to fall so that a retention measure of one skill area (multiplication facts) could be obtained using post test scores for the project and pretest scores for the project extension. This data is presented in Table 5.

Significance: Bottom Half of the Class

In many cases the statistical significance for the lower half of the class shows a decline from the significance of the class as a whole. This is seen as a function of cutting the N used for analysis in half rather than a decrease in effectiveness with slower students.

Nature of Measurement Instruments

The W.R.A.T. data as reported in the manual shows a reliability coefficient ranging from .940 to .962 for the age ranges involved and for the arithmetic subtest. The Standard Error of Measurement ranges from .98 to 1.42. The W.R.A.T. has a Standard Deviation of 15 and a mean of 100. Criterion tests are 10 item tests except for the math facts which are a total measure of all math facts 0-12. Test retest reliability for criterion instruments is reported in Table 4.

Method of Scoring Criterion Tests

Criterion tests were scored for both Process and Total. Process is defined as those procedures involved in the direct performing of the respective task. Process does not involve prerequisite skills, it only involves the skill being taught. For example, long division involves borrowing at times but borrowing errors would not be counted against the long division process. Total is defined as those total aspects that lead to a correct answer to the problem. This involves the respective process and all prerequisite skills. For example, long division involves borrowing at times and a borrowing error would be counted against the total score.

The reason for this division of scoring is two fold. (1) The skill being taught does not generally involve the teaching of the prerequisite skills in most classrooms. (2) Handicapped pupils who are mainstreaming often sit through instruction for which they do not have the necessary prerequisite skills. This leads to negative learning. This necessitates giving handicapped pupils (and regular student) feedback that they are doing the process right even though they are missing the answer because of prerequisite skills. In the final analysis of course somebody, somewhere, must still teach the prerequisite skills but when they do, hopefully, they will not have to undo negative learning.

Method of Error Detection

Every tenth test was rescored in order to detect scoring errors. Classes in which two or more errors were detected were completely rescored.

Discussion of Results

In almost all cases, results were in favor of the experimental group. Enough areas reached significance to suggest that there is potential in programming for handicapped pupils in the regular classrooms. There were enough areas that did not obtain statistical significance to indicate that in many cases much testing and revision of material may be necessary in order to obtain this goal in a consistent manner. It may be advisable to have grants run longer (say three years) in order to provide sufficient time for cycles of field testing and product revision. In order for materials to be readily utilized by regular classroom teachers under regular classroom conditions without extensive inservice and classroom management procedures or without the addition of aides or etc. (conditions which limit the dissemination and adaption of material) it places considerable strain on the quality of material programming. Such sophistication of material may well require more than one revision cycle in order to be developed. However, if the mandate of the "least restrictive environment" is to become a constructive reality then a strengthening of the regular classrooms instruction program needs to occur. The approach of the project offers one possible way to accomplish this goal.

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